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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/966,719	09/27/2001	Tatsuya Miyatani	S004-4403	6392

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EXAMINER	
JOHNSTON, PHILLIP A	
ART UNIT	**PAPER NUMBER**
2881	

DATE MAILED: 01/16/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

PTO-90C (Rev. 07-01)

Office Action Summary	Application No.	Applicant(s)
	09/966,719	MIYATANI ET AL.
	Examiner	Art Unit
	Phillip A Johnston	2881

-- *The MAILING DATE of this communication appears on the cover sheet with the correspondence address* --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____ .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-17* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-17* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *27 September 2001* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☒ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

Detailed Action

Claims Rejection – 35 U.S.C. 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which the subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. Claims 1-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 5,204,531 to Elings, in view of Adderton, U.S. Patent No. 6,189,374.

Elings (531) teaches that most SPM's currently use piezoelectric actuators that are constructed to achieve three-axis scanning with very high resolution. The most common type of scanner used for SPM's are piezoelectric materials formed into the shape of a tube. Electrodes are placed on this tube such that longitudinal bending motions constitute the lateral scanning motions, and shortening or lengthening of the tube constitute the vertical scanning motions. These tubes are very rigid. In addition, SPM's are usually operated in a feedback mode, where, as the sample is scanned laterally in a raster pattern, the sample or tip is adjusted vertically to maintain the measured interaction parameter at a constant, predetermined value. The adjustment

information as a function of lateral position forms a topographic map of the scanned surface. The feedback implementation is critical to the operation of an SPM, as high performance feedback systems allow for faster, more accurate imaging.

Elings (531) discloses in Figure 1, an SPM wherein a typical scan of a raster pattern is comprised of hundreds of scan lines, a scan line being one excursion back and forth in the x-direction. The scanner moves back and forth in one lateral direction, x, at a relatively high rate while the scanner is displaced back and forth in an orthogonal lateral direction, y, at a much lower rate. Thus the scanner repetitively scans a rectangular area. This motion is achieved by applying waveforms shown in FIG. 2 to the corresponding x and y electrodes 32 and 34, respectively on the scanner 30 as illustrated in FIG. 3. Typically, the frequency of the x-direction waveform is hundreds of times higher than that of the y-direction waveform. Historically, triangular waveforms are applied in SPM's to achieve the desired motions, similar in function to the triangular waveforms used to create the raster scans in cathode ray terminals or television sets. However, Elings (531) has shown that non-linear waveforms that compensate for the piezoelectric non linear behavior are preferable. See Column 2, line 57-68, and Column 3, line 1-35. A scan at a first scan size is cycling at 50, which provides the scan area and scan motions 55 of the SPM probe across a surface under analysis. The operator of the SPM decides to change the scan size to a second size (step 51). The SPM responds to the operator request by scaling the x and y scan drive voltages accordingly. Before imaging the new scan area, the x drive is precycled for a small number of scan lines at the second scan size (step 52 which provides

x-direction precycling scan motion 56 as shown in FIG. 5). X-direction precycling consists of displacing the probe at the second scan size in the x direction at a relatively high rate. The relative high scanning rate quickly settles the x-direction sensitivities. It is convenient to use a precycling rate which is the same as the X scan rate. Subsequently, the y drive is precycled for a small number of scan lines at the second scan size. See Column 5, line 21-43.

Elings (531) also discloses an SPM that has the generation of the scan drive waveforms under computer control. A computer controlled system would allow for the invention to be implemented with optimum performance. The rate at which the scanner can be cycled without degrading the sample or the probe depends on the size of the scan and the roughness of the sample terrain. The computer can be easily programmed to adjust the cycling rate for the scan size, and even for the terrain that was encountered on the previous scan, to optimize the cycling rate while minimizing the possibility of tip or sample damage. It is well known that a surface having a smooth topoqraphy may be scanned at a higher rate than a surface with a highly variable topography, such as an integrated circuit. A highly variable topography can be detected by the computer due to the larger feedback variation necessary to maintain the appropriate tip-surface separation, and the scanning rate can be accordingly adjusted, and stored for later reference when changing scan size . See Column 7, line 35-55.

Adderton (374), discloses an AFM wherein, two feedback loops are employed. The first feedback loop controls the self-actuated cantilever to maintain a relatively

constant force between the tip of the cantilever and the sample surface. The second feedback loop controls the standard Z actuator, at a lower speed than the first feedback loop and serves either (1) to keep the self-actuated cantilever within its operating Z-range or (2) to maintain the linearity of the positioning sensitivity of the cantilever when following low frequency topography. See Column 5, line 24-32.

Adderton (374) also discloses an AFM 10 that includes two feedback loops 12 and 14 that control an AFM Z-position actuator 16 and a probe assembly 18, respectively. Probe assembly 18 includes a self-actuated cantilever 20 having a tip 26 that interacts with a sample during scanning. When scanning in contact mode, tip 26 generally continually contacts the sample, only occasionally separating from the sample, if at all. For example, at the end of a line scan tip 26 may disengage the sample surface. While it scans the surface of the sample, cantilever 20 responds to the output of feedback loop 12 to ultimately map the topography of the surface of the sample. In operation, the interaction between tip 26 and sample surface 28 causes the deflection of cantilever 20. To measure this deflection, AFM 10 includes a deflection detector 30 that may preferably be an optical detection system for measuring the cantilever deflection. See Column 7, line 15-35.

Hence, it would have been obvious to one of ordinary skill in the art that Elings (531) SPM can be modified to use the feedback control apparatus and method , in accordance with the teaching of Adderton (374), to increase the imaging accuracy and speed of the scanning system, if so desired.

Conclusion

3. Any inquiry concerning this communication or earlier communications should be directed to Phillip Johnston whose telephone number is (703) 305-7022. The examiner can normally be reached on Monday-Friday from 7:30 am to 4:00 pm. If attempts to reach the examiner by telephone are unsuccessful, the examiners supervisor John Lee can be reached at (703) 308-4116. The fax phone numbers are (703) 872-9318 for regular response activity, and (703) 872-9319 for after-final responses. In addition the customer service fax number is (703) 872- 9317.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703 308 0956.

PJ
January 6, 2003

JOHN R. LEE
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2800